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THE MISSION OF THE LAND-GRANT COLLEGES IN PROMOTING OUR GOOD NEIGHBOR POLICIES AMONG THE LATIN AMERICAN REPUBLICS[1]

By E. J. KYLE

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WHEN the Morrill Act was passed by our United States Congress and approved by Abraham Lincoln in 1862, it brought into the world the first truly democratic program of higher education. It announced to the world that the people of this country believed that the son of the farmer, the son of the mechanic and the son of the shopkeeper were just as much entitled to an education in an institution of higher learning as the son of the independent rich. It also brought into the world for the first time the idea that the state and federal governments should help finance any form of higher education.

The masses of the people of the United States have never fully understood the mission or the work of the land-grant colleges, and, not understanding them, our people have never fully appreciated their accomplishments.

In this terrible and tragic world situation, when the forces of evil are striving with all their might to destroy completely the democratic peoples of the world

[1] An address delivered before the general session, Association of Land-Grant Colleges, Chicago, October 28, 1942.

and the democratic institutions they have developed, these land-grant colleges are meeting the acid test. From their laboratories, classrooms and drill fields have come many of the engineers who are solving our technical problems and many of the agricultural leaders who are directing the production of the food and raiment of our armed forces and the armed forces and civilian populations of our allies.

Let it be fully understood that at the same time they are rendering this vital constructive service they are placing upon the firing lines in every section of the world where fighting is in progress tens of thousands of our best trained and most efficient officers.

Yes, the land-grant college has met the supreme test in a big, definite and constructive way. The fine accomplishments of these colleges have vindicated a thousand fold the keen and far-seeing vision of those great men who saw clearly during troubled times in their own day the fundamental needs of a democratic world nearly one hundred years in the future.

I am convinced that the time has come when the land-grant college system, in addition to continuing its work in a still bigger way at home, must offer to a stricken and prostrate world its democratic plan of higher education.

This is especially true of our friends and neighbors among the Latin American countries. We are now presented with this opportunty. If we pass it by, the opportunity may not come again; if not, we will have missed forever the chance to look into the future with the clear vision and big souls of Justine Morrill, Abraham Lincoln and their associates.

When we bring this war to a victorious close, which we most assuredly are going to do, we are going to find ourselves confronted with the most vital and at the same time the most difficult and complicated problems ever to confront a people during peace times.

When this war closes, it is going to leave many of what were once the most powerful nations in the world completely paralyzed politically, socially and economically. World commerce will be completely disrupted and broken. All fundamental organizations for the development and promotion of the agencies for the civilization of mankind will have been greatly weakened or perhaps totally destroyed. There will arise, therefore, from this world catastrophe an appealing and urgent opportunity for some nation to hold aloft the light of civilization, to point and to lead the way back to a sane, sound and just plan of life for all nations, even those whose treachery and barbarity have brought civilization to its lowest ebb in many centuries.

The foundation for a new world order must be laid broad and deep. This new world order must take every precaution against the recurrence of another disastrous world conflict. If this is to be accomplished, there must be a united, prosperous and contented confederation of the American Republics.

This, in my judgment, can best be accomplished by the United States Government making every possible effort to encourage and promote the establishment of a system of land-grant colleges throughout the Latin American Republics.

I had, through the courtesy of Nelson Rockefeller, Coordinator of Inter-American Affairs, an opportunity to visit most of the Latin American countries during the late summer and fall of 1941. One of the main purposes of this tour was to visit and inspect their educational institutions.

On this tour I visited the following educational institutions in the order listed:

(1) Escuela Nacional de Agricultura. This is the national agricultural college of Mexico, located at Chapingo, some thirty miles from Mexico City. There are about 500 students attending this institution. They come from practically every state in Mexico, and most of them are on scholarships. They have fairly good buildings and a good faculty. Some of their courses require seven years for completion and they give a degree of "Engineering in Agriculture." Military training has recently been introduced at this institution.

(2) Accompanied by the Minister of Agriculture, who is a graduate of the University of California, I visited the agricultural college at San Jose, the capital of Costa Rica. This institution is limited in buildings and those they have are not in good condition and are poorly equipped. It has few students and a small faculty. It needs finances very badly. The people are earnest, hard-working and deserving of help.

(3) During my three weeks in Venezuela I visited the Instituto Experimental de Agricultura at Caracas, the capital. There are few students in this institution and most of the work is along research lines. They seem to be doing good work. At Caripito in eastern Venezuela, I inspected the Escuela Rural Andres Bello, a grade school which is operated through the generosity of the Standard Oil Company. This school teaches the children domestic science, agriculture and manual training. There is deep interest and great enthusiasm for the work. At Maracay, in the interior about a hundred miles from Caracas, I inspected the two-year practical agricultural school, where there are two instructors and about sixty boys. They have fairly good buildings with good equipment. They are doing an interesting piece of work.

(4) I then went to Trinidad, where I visited the Imperial College of Tropical Agriculture. This is a

British-owned institution where they do considerable research but have only a few students, most of them doing graduate work. These students are trained primarily in tropical agriculture and are used in the tropical countries under the control of the British Dominion.

(5) Upon arrival in Brazil, I flew a thousand miles up the Amazon River to Manaos, where I visited the two-year practical agricultural school supported by the State of Amazonas. This school has two teachers and about two hundred boys enrolled. Though they have poor buildings and poor equipment, their boundless enthusiasm enables them to do a good piece of work. This is a very deserving institution.

I then flew back to Belem, at the mouth of the Amazon, and inspected the new research institution that is being built near the city by the Government of Brazil. This institution will deal primarily with research problems relating to rubber, but at the same time will make a study of other tropical problems common to that great section.

They are putting up splendid buildings, have a large tract of land, have selected a strong group of specialists and it is my prediction that good work will be done.

They have recently relocated and rebuilt their agricultural college at Recife. They have good buildings, splendid equipment, a strong faculty and a large number of students. I think they have the best collection of insects to be found anywhere in the world.

My next stop was at Bahia. In company with the Secretary of Agriculture, I went inland about one hundred miles and visited the new agricultural college being built at Cruz Des Almos. The governor of this state is a former student of the A. and M. College of Texas. He is enthusiastic about the development of agriculture and plans to spend about $700,000 on this institution. Three buildings were nearing completion —the main building, the Chemistry Building and the Agricultural Building. A large tract of land is connected with the institution.

At a site some thirty miles from Rio de Janeiro, the Government of Brazil is building a National Agricultural University. They have a large tract of land, and a fine group of buildings is under construction. They expect to spend approximately $5,000,000 on this institution. It will probably be at least two years before it is completed. This is the finest physical agricultural plant I have ever seen. It gives promise of being the outstanding educational institution in all Central and South America.

At Sao Paulo I went inland to visit the Escola Superior de Agricultura, located at Piracicaba. This is said to be the oldest and best agricultural college in Brazil. They have good buildings that are well equipped and a splendid faculty that is doing fine work.

Upon my return to Sao Paulo, I visited the Animal Husbandry and Agricultural College and Experiment Station. They have good buildings well equipped and a fine group of specialists.

I visited Port Alegre in southern Brazil. They do not have an agricultural school but are now making a strenuous effort to secure a college modeled after our land-grant colleges.

(6) Though I did not visit the agricultural college in Argentina, located at Buenos Aires, I had a very interesting conference with a member of the faculty and with the Assistant Secretary of Agriculture.

(7) While at Santiago, the capital of Chile, I visited and inspected the veterinary college and the agricultural college. They have inferior buildings, poor equipment and small faculties. They have few students. These institutions need and deserve much greater financial assistance than they are getting at the present time.

(8) While I was in Lima, Peru, the Minister of Agriculture took me to the agricultural college located about thirty miles from the city. A severe earthquake almost destroyed this institution about two years ago. They have few and poorly constructed buildings, a small faculty and few students. They have a small tract of land. This is another institution that needs financial assistance.

While on my tour I visited, in addition to the colleges, a large number of experiment stations, demonstration farms, ranches, dairies and other agricultural enterprises and talked with people in every walk of life.

A detailed account of my study of the educational institutions of the Latin American countries is given in my Number II report to Nelson Rockefeller.

As a result of this tour, during which time I also made a careful study of the agricultural economy of those countries, I became firmly convinced that the best possible assistance this nation can render those countries is to aid them in developing educational institutions modeled after our own land-grant colleges. The reasons for this are very clear.

The last great frontier of the Western Hemisphere now lies south of the Rio Grande. We in the United States have already consumed most of our natural resources. Europe has almost completely exhausted hers, primarily in waging wars.

The Latin American countries are tremendously rich in natural resources consisting of both minerals and agricultural products. What they need, and need urgently and desperately, is a group of trained lead-

ers or specialists to develop their resources. They especially need men trained in agriculture, engineering, particularly sanitary engineering, and veterinary medicine.

Those countries do not need assistance in art and music and such subjects. They are as well or better developed than we are along those lines. What they need is democracy in their institutions of higher learning that can come best, as it has to us, through a system of land-grant colleges modeled after ours.

RECOMMENDATIONS

I am thoroughly convinced that the United States has its best opportunity to promote complete and lasting understanding and friendship with our neighbors to the south by cooperating with them on a strictly practical basis in the development of their courses of study in agriculture, engineering and in veterinary medicine, and in aiding them to better equip their physical plants and to strengthen their faculties.

This can be accomplished best by the following actions:

(1) We should propose to the respective governments that we appoint a commission to make a careful study of their educational systems and experiment stations. This commission should have on it a representative of the Office of the Coordinator of Inter-American Affairs, the Department of State, the Office of Education, the Department of Agriculture and three representatives of the land-grant colleges—one to represent agriculture, one engineering and one veterinary medicine. This commission should visit all the countries to be included in the survey in order to be able to make comparisons and thus insure a report and recommendations that will be fair and just to every country concerned. This report, with recommendations, should be submitted to each of the Latin American Republics.

(2) Steps should be taken immediately to increase the supply of visiting teachers from this country to all institutions desiring them. These teachers should be carefully selected from the agricultural, engineering and veterinary faculties of our country, both as to their ability to fit into the social and economic life of the Latin American countries and to meet the educational requirements. A considerable number of scholarships, at least five hundred, should be set up by this government so they could be awarded, without too much red tape, to their most intelligent young men to enter our educational institutions for the purpose of securing advanced training in agriculture, engineering, veterinary medicine and home economics.

It is highly important for these young men to secure this training as soon as possible in order that they may return and strengthen the faculties of the institutions in those countries or become specialists in the industrial and agricultural development of their countries.

Practically all the countries visited, except Argentina, are lacking in improved breeds of livestock—both beef and dairy cattle, horses, hogs and poultry. I am convinced that the exportation of outstanding representatives of these breeds to educational institutions and experiment stations of those countries would rank next to the awarding of scholarships in the rendering of a great service to the people of those countries and the promotion of friendly relations. These breeds should be carefully selected. They should be sent only to the countries where experience has shown the climate and soil to be congenial. Most of these countries have native breeds that can be used as a foundation on which to build. A good example of this can be found in the native Criollo cattle of Venezuela and central and northern Brazil. This is a strong, vigorous, big-boned breed that is well adapted to those countries.

In conclusion, let me say that I found the people of practically every country visited to be extremely kind and gracious. They are anxious for an opportunity to cooperate with us to the fullest extent in educational matters.

I am convinced that most of the countries of Central and South America are on the eve of a great industrial and agricultural awakening, similar to that period in our history some fifty to sixty years ago. The opportunity has presented itself. It remains to be seen whether we will avail ourselves of this opportunity to render a great public service and at the same time strengthen our bonds of friendship with our neighbors to the south.

There are two great problems facing the world today; the first and most urgent and pressing is to win the war, the second is to win the peace at the close of the war. There is no doubt in my mind but what we will win the war. There is, however, much doubt in my mind about winning the peace. We won World War I, but we lost the peace and lost it miserably.

There is little doubt but what the United States is going to be faced with the responsibility of winning the peace at the close of this war. We are going to need the full cooperation and support of the Latin American countries in carrying through our program to a successful conclusion. In my judgment, the best way to secure this is through educational channels, especially through the education of their young men in this country.

HEAT-LABILE, AVIDIN-UNCOMBINABLE, SPECIES-SPECIFIC AND OTHER VITAMERS[1] OF BIOTIN[2]

By Dr. DEAN BURK and Dr. RICHARD J. WINZLER

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OPPEL[3] has recently reported that normal human urine contains a considerable proportion (some 20–50 per cent.) of its yeast-growth biotin activity (≏ *ca.* 0.05 mg biotin/l) in a form unaffected by addition of avidin or egg white. We have also found normal urines of dog, horse, rat, mouse, cow and sheep to contain as high or higher proportions of avidin-uncombinable active material,[4] and even greater total activities (≏ 0.08, 0.1, 0.3, 0.5, 0.5 and 1 mg biotin/l). In fact, most all tissues and foodstuffs, analyzed after 2 hours' autoclaving in 5 vol.-per cent. H_2SO_4, were found to contain readily measured proportions of yeast-active, avidin-uncombinable biotin vitamer, thus: 0.1 per cent. or less, biotin concentrates (Smaco #200 and I.G.F. liver extract), egg yolk, egg white, avidin concentrates; 0.1–1 per cent., rat muscle, pancreas, kidney, liver, submaxillary gland and whole carcass, and mouse carcass; 1–10 per cent., rat lung, spleen, testis, adrenals, lymph nodes, skin, intestinal tract contents and feces, and polished rice, dried yeast and various chows; 30–50 per cent., Vitab[4a] (rice bran concentrate), and (unhydrolyzed) beer; 90–100 per cent., urine of rats or mice fed avidin, and Squibb urease.

A remarkable feature of the avidin-uncombinable fraction is that its yeast activity is, unlike that of biotin, greatly reduced (60–90 per cent.) by boiling or autoclaving crude preparations (*e.g.*, urine, Vitab) for 15 minutes to 2 hours at physiological pH values. The reduction obtained increases with pH over the range 4–9, and decreases with dilution of preparation employed during autoclaving. The heat-labile, avidin-uncombinable fraction, which is further characterized by inactivity for Rhizobium growth, has been designated as *miotin*. The residual, comparatively heat-stable, avidin-uncombinable fraction, which evidence indicates is almost certainly produced during autoclaving from miotin, has been designated as *tiotin*.

The activity of miotin preparations is, like that of biotin, little if at all affected by 2 hours' autoclaving in 5 per cent. H_2SO_4 (120° C). Subsequent autoclaving at pH 4–9, however, produces much less reduction in activity than occurs without the prior acid autoclaving. Acid autoclaving thus either produces still another biotin vitamer from miotin of about equivalent activity (but of greater stability to neutral autoclaving) or eliminates some extra component in the crude preparation needed to produce the tiotin of lesser activity than miotin. The existence of such an additional component is also indicated by the dilution effect referred to (*i.e.*, second order reaction involved). The component is not a dissociable inhibitor of miotin because neutral-autoclaved miotin preparations did not inhibit the activity of unautoclaved miotin preparations; other experiments show that the component is not simply bicarbonate. Acid autoclaving of tiotin preparations restores most of the original avidin-uncombinable activity, which is now again little affected by further neutral autoclaving. The reconversion of tiotin to miotin during acid autoclaving (with gain in activity), as well as the conversion of miotin to tiotin during the initial neutral autoclaving, are thus strongly indicated, although formation of still other vitamers of biotin is not precluded. In all the foregoing autoclaving operations, no appreciable formation of avidin-combinable biotin vitamer was definitely detected.

A third definite but unidentified biotin vitamer, *rhiotin*, active for Rhizobium but not for yeast, and

[1] Compounds that act to overcome a given vitamin deficiency (in one or another organism, animal or plant) are vitamers (vitameric), according to nomenclature developed with K. Hickman, Gibson Island Vitamin Conference, July 22, 1942; thus, there are various D vitamers, K vitamers, B_1 (or thiamin) vitamers, niacin vitamers, pantothen vitamers, pyridoxin vitamers, para-aminobenzoic acid vitamers, and, as indicated in this paper, various biotin vitamers. Whereas isomers are compounds with a given molecular formula, vitamers are compounds with a given vitamin activity and usually possess different molecular formulas.

[2] Reported upon at Gibson Island Chemical Growth Factors Conference, August 21, 1942, and Chemical Society of Washington, October 8, 1942.

[3] T. Oppel, "Studies of Biotin Metabolism in Man," reported at the thirty-fourth annual meeting, Am. Soc. Clin. Invest., Atlantic City, May 4, 1942; *Am. Jour. Med. Sci.* (I, II, III), in press.

[4] The assay and definition of avidin-combinable and -uncombinable biotin vitamers was made by growing organisms (*e.g.*, yeast, Rhizobium) in serial dilutions of unknowns in the presence and absence of avidin (*ca.* 0.001 units/cc), compared with standard dilutions of biotin. The exact quantitative measurement of the avidin-uncombinable fraction requires a definite correction for the fact that avidin not only combines with avidin-combinable biotin vitamers in the growth medium, but, especially at the lower yeast growths, also exerts a considerable toxic effect (increasing up to 50 per cent. over the range 10^{-6} to 10^{-2} avidin units/cc) on the growth of yeast supplied avidin-uncombinable biotin vitamers, and even of yeast internally rich in biotin (no biotin vitamer added to medium). Avidin and avidin-biotin were found by direct measurement to be removed from the medium and highly absorbed by yeast, to the extent of several tenths of a per cent. of the yeast dry weight. Avidin-biotin so absorbed was not available as a source of biotin for growth.

[4a] Kindly supplied by National Oil Products Co., Harrison, N. J.

avidin-combinable and stable to acid or neutral autoclaving, was found in biotin-free concentrates of miotin prepared from human or rat urines (or Vitab hydrolyzates) by treatment with excess avidin followed by precipitation of the biotin-avidin complex with acetone and concentration of the liquid residue at pH 1–2 under reduced pressure at 50–60° C.

Injection tests to date with mice indicate zero or greatly reduced vitamin H activity by either rhiotin or miotin when compared, at yeast-equivalent doses, with curative doses of biotin (0.1 gamma/mouse/day). The vitamin H requirement of the mouse is somewhat higher than that of the rat, and deficiency symptoms are somewhat easier to induce, in agreement with the somewhat higher biotin content of the mouse carcass on a weight basis. The low or zero vitamin H activity of miotin for the rat and mouse is further confirmed by the fact that biotin-deficient animals maintained for weeks or months on diets containing excess avidin continued to excrete normal amounts of avidin-uncombinable (though no avidin-combinable) biotin vitamer in their urine. Furthermore, pure cultures of *E. coli* (and likewise many miscellaneous culture contaminants found in unsterile stock solutions) were found to synthesize and liberate large amounts of extracellular biotin vitamer, over half of which was avidin-uncombinable.

The relations between the foregoing chemically unidentified biotin vitamers and those of known constitution are summarized in Table 1, the data of which must be interpreted with due appreciation of the nature and sensitivities of the usual or implicit techniques employed. We have confirmed the finding[8] that the diaminocarboxylic acid derived from biotin (DAC), a sample of which was initially given us by Professor du Vigneaud, is avidin-uncombinable,[4] and possesses under usual test conditions only about 0.1 the molal equivalent yeast activity of biotin (0.1 BVE for yeast), at half-maximum growth. Much less than this activity will be obtained, especially at the low DAC concentrations, if the yeast inoculum is not quite fresh or is biotin-deficient, or if (as found by du Vigneaud and collaborators also) the CO_2 pressure in the growth medium is inadequate. The CO_2 pressure requirement for growth in DAC is much greater than in biotin, miotin or tiotin, and maximum DAC activity at limiting DAC concentrations requires a CO_2 pressure greater than that in air (> 0.03 per cent. atm.). All three factors indicated will, when inadequate, tend to produce more extended DAC concentration curves, and all probably affect the conversion of DAC to biotin in its utilization by yeast. The conversion of DAC to biotin, even under optimum conditions observed, is very probably the rate-limiting reaction that determines its maximum observed activity in yeast of about 0.1 BVE. We have further found that DAC is inactive for Rhizobium (≦ 0.001 BVE for Rhizobium), and that, like miotin, its activity may be reduced, about as rapidly, by autoclaving, especially in the pH range 4–9. Pimelic acid, which may substitute for biotin in the growth of the diphtheria bacillus,[5] was not observed to substitute for biotin in the growth of Rhizobium or yeast, in either

TABLE 1

SPECIES-SPECIFICITY AND OTHER OBSERVED PROPERTIES OF VARIOUS BIOTIN VITAMERS

Biotin vitamer	Identified					Chemically unidentified		
	Biotin	Methyl ester	Sulfoxide[7]	Diaminocarboxylic acid (DAC)	Pimelic acid	Miotin	Tiotin	Rhiotin
Species activity								
Yeast (*S. cerevisiae*, Fleischmann strain 139)	+	+	+	+(ca. 0.1 BVE)	−	+	+(<0.4 BVE)	−
Rhizobium trifolii, str. 209	+	+		−(≦0.001 BVE)		−	−(sl?)	+
Rat	+	+						
Mouse	+					(−)		(−)
C. diphtheriae, Allen str.[5]	+				+			
L. casei[6]	+	−			−			
Thirteen fungi[9]	+				−			
Autoclaving stability (2 hrs., 120°C.)								
pH 4–9	+	−		−		−	+	+
5 vol.–% H_2SO_4	+	−		+		+	−	+
Avidin-combinability[4]	+	+	+	−		−	−	+
Conversion to avidin-combinable biotin vitamer by:								
Yeast				+		+	+	
Phosgene				+		−	−	

[5] V. du Vigneaud, K. Dittmer, E. Hague and B. Long, SCIENCE, 96: 186, 1942.

[6] G. M. Shull, B. L. Hutchings and W. H. Peterson, *Jour. Biol. Chem.*, 142: 913, 1942; L. D. Wright, *Proc. Soc. Exp. Biol. Med.*, 51: 27, 1942.

[7] V. du Vigneaud, Gibson Island Vitamin Conference, July 22, 1942.

[8] V. du Vigneaud, K. Dittmer, K. Hofmann and D. Melville, *Proc. Soc. Exp. Biol. Med.*, 50: 374, 1942.

the presence or absence of added cystine. Robbins and Ma[9] reported that pimelic acid did not substitute for biotin in the growth of some thirteen fungi. Eakin and Eakin[10] inferred a synthesis of biotin by *Aspergillus niger* from either pimelic, suberic or azelaic acid as precursor, with supplementary action by cystine. In further regard to species-specificity of biotin vitamers, it will be recalled that the avidin- combinable, heat-labile methyl ester of biotin is active for yeast and Rhizobium but not for *L. casei*.[6]

The existence of various biotin vitamers, especially their coexistence in natural sources, makes essential their consideration in most phases of biotin investigations, particularly methodology. Thus, total yeast biotin vitamer activity may by no means be a measure of vitamin H activity, with certain preparations and test animals. Rhizobium, employed as a test organism by West and Woglom[11] in their studies of biotin content of tumors and normal tissues, does not measure the miotin or tiotin, but would measure any rhiotin as well as biotin. The use of avidin to determine the biotin requirements of organisms grown in complex media is obviously subject to limitation when other vitamers of biotin are present in the medium. At present it seems that more complete and thorough biotin vitamer analyses would best be carried out by using different organisms, with and without added avidin.[4] In preparing samples for analysis to include bound forms of vitamers (found in most natural materials, with the important exception of urines), it would be best to heat or autoclave wet or mildly oven-dried samples in acid (5 per cent. H_2SO_4) but not neutral solutions.[11a] Heating in neutral solution would tend to decrease the avidin-uncombinable vitamer content; whereas excessive or prolonged oven drying tends to increase the avidin-uncombinable fraction of tissues at the expense of the avidin-combinable fraction, thus, in rat carcass from about 1 to 30 per cent. after many days' oven drying.

Various lines of evidence (biological, kinetic and chemical) indicate that miotin, tiotin and rhiotin are closely related to biotin chemically, and that the mechanism of their substitution for biotin in growth does not rest on some entirely different basis than close chemical relationship. The biochemical conversion of avidin-uncombinable to avidin-combinable biotin vitamers by yeast was tested by growing yeast in preparations containing respectively only biotin, miotin, tiotin, DAC and avidin-biotin,[4] at submaximal concentrations such that the vitamers were completely removed from the growth medium. These variously grown yeast preparations were centrifuged and analyzed for avidin-combinable and avidin-uncombinable forms of yeast-active biotin vitamers. In all cases, 90–98 per cent. combinable form was obtained, indicating extensive conversion of miotin, tiotin and DAC to avidin-combinable vitamer (presumably biotin), and also, to some degree, the conversion of free biotin to avidin-uncombinable form (presumably miotin). The conversion of miotin to avidin-combinable form was quantitative within error of measurement of activity, strongly indicating close chemical relationship with biotin. The conversion of tiotin and DAC by yeast to combinable vitamer involved a three to ten fold increase in total biotin vitamer activity, in line with expectation for the less active DAC, and again indicative that tiotin has a lower molal equivalent activity than biotin or miotin. Miotin added to biotin-deficient yeast in Warburg manometers produced the same rapid kinetic increase in fermentation and respiration rates that was earlier reported for biotin,[12] whereas, at growth-equivalent submaximal concentrations, tiotin and DAC were definitely less effective than biotin or miotin, and required longer periods of time to produce a given effect. Miotin like biotin is dialyzable from urine, and in tissues exists largely in bound form. The miotin/biotin ratio was little affected by ordinary chromatographic procedures with charcoal applied to urine.

The chemical conversion of DAC to biotin has been accomplished with phosgene by Melville, Hofmann and du Vigneaud.[13] We accordingly treated biotin, miotin, tiotin and DAC, respectively, in 2M alkali with 0.2 parts 20 per cent. phosgene in toluene in the cold. A large proportion of the avidin-uncombinable DAC was recovered as more active avidin-combinable biotin vitamer, whereas no effect was noted with the other vitamers so treated. DAC can thus be readily distinguished from miotin, tiotin or rhiotin on the basis of differences in either heat stability, equivalent molal activity, CO_2-growth effect, species-specificity, avidin-combinability or, chemically most decisive, action of phosgene. Nevertheless, demonstration of the possible relationships between these chemically unidentified vitamers with stereo- or other isomers of biotin, carboxy-DAC, dicarboxy-DAC or other derivatives or conjugated forms of biotin must await actual isolation of the unidentified vitamers in the pure state.

In regard to the fundamental function of biotin and biotin vitamers in living matter, it is important to reflect that the existence of a urea ring that

[9] W. J. Robbins and R. Ma, SCIENCE, 96: 406, 1942.
[10] R. E. Eakin and E. A. Eakin, SCIENCE, 96: 187, 1942.
[11] P. M. West and W. H. Woglom, *Cancer Research*, 2: 324, 1942.
[11a] Or, when otherwise desirable, use enzymatic hydrolysis (*cf.* M. A. Pollack, A. Taylor, A. Woods, R. C. Thompson and R. J. Williams, *Cancer Research*, 2: 748, 1942).
[12] D. Burk, R. Winzler and V. du Vigneaud, *Jour. Biol. Chem.*, 140: xxi, 1942.
[13] D. B. Melville, K. Hofmann and V. du Vigneaud, SCIENCE, 94: 308, 1942.

may be opened or closed either chemically[14] or biologically by yeast with respectively loss and gain of CO_2, the increased CO_2 pressure function in DAC as compared with biotin utilization, and other evidence at hand, all suggest the interesting possibility that biotin and its vitamers may act, possibly in alternation between avidin-combinable and -uncombinable forms if these are related to urea ring structure, as a *coenzyme of CO_2 transfer,* either in CO_2 utilization or CO_2 production (just as coenzyme I transfers hydrogen, or adenylic acid transfers phosphate). Such a function could underlie its already established role in heterotrophic fermentation, respiration and growth[12,15,16] as well as a possible role in autotrophic CO_2 assimilation, chemosynthetic or photosynthetic.

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OBITUARY

FRANZ BOAS

IN the death of Professor Franz Boas on December 21st at the age of 84 America loses one of its great scientists. To the day of his death he had continued his indefatigible research in ethnology, linguistics and in problems of race and of human growth. The wisdom gained from a long lifetime of scientific research was lodged, during the last years of his life, in a feeble body, but it was not dimmed.

Franz Boas at the time of his death was professor emeritus of anthropology at Columbia University. He was born in Minden, Westphalia, and was educated at the universities of Heidelberg, Bonn and Kiel, where his particular fields of study were physics, geography and mathematics. The subject of his doctoral dissertation presented to the University of Kiel was "The Nature of the Color of Sea Water," and his first act after receiving his degree was typical of the man. He had already arrived at his life-long conviction that for most scientific problems mere examination of the existing data or cunningly devised laboratory experiments are not enough; he saw the necessity of gathering new first-hand material on conditions as they actually exist in human experience. He wanted, in fact, to investigate sea water and ice under winter conditions in the Arctic. There were no scientific funds to send a young man to winter among the Eskimos with his scientific instruments, so he financed himself by arranging with Berlin papers to act as a newspaper correspondent from the Arctic. He set out as a young philosophic materialist accustomed to seek "causes" in the natural environment; as he said much later, he went to the Arctic with "an exaggerated belief in the importance of geographical determinants." He returned with an abiding conviction that if we are ever to understand human behavior we must know as much about the eye that sees as about the object seen. And he had understood once and for all that the eye that sees is not a mere physical organ but a means of perception conditioned by the tradition in which its possessor has been reared.

He turned therefore to the study of culture. After a few years in Germany he returned to America under the auspices of the British Association for the Advancement of Science to study the tribes of the Pacific Coast of Canada. For fifty years he was to continue his intensive work among these tribes, especially among the Kwakiutl. Every detail—linguistic, physical, archeological and cultural—was, it seemed to him, grist for his mill. No student of culture has ever been more tireless. On his first trip he interested himself in the languages, recorded texts in hitherto unwritten tongues, investigated complex forms of social organization and of economics, observed ceremonies and financial exchanges in minute detail. But this seemed to him only a beginning, and in 1897 he interested Morris K. Jesup, then president of the Museum of Natural History, to finance the Jesup North Pacific Expedition in order that archeological, linguistic and cultural investigation might be carried on by a number of investigators both in the New World and in Siberia. Boas directed the work and the resulting publications which he edited are a landmark in the history of the investigation of cultures historically unrelated to Western civilization. Even as late as 1930 he returned to the Kwakiutl for more fieldwork, and in 1937, no longer able to go to them, he brought a Kwakiutl to his home for the winter.

Boas' emphasis on obtaining accurate, detailed knowledge, both intensive and extensive, not only raised the standards of anthropology; it changed its methodology and problems. In phrasing these problems and in insisting that relevant data be used in

[14] Enzymatically, Squibb crude urease added to the growth medium had no effect (except general toxicity at above 100 mg/1) on the yeast growth activity of biotin, tiotin, miotin, DAC or biotin-avidin, each component (vitamer and urease) being varied over a wide range of concentration.

[15] F. E. Allison, S. R. Hoover and D. Burk, SCIENCE, 78: 217, 1933.

[16] P. György, D. B. Melville, D. Burk and V. du Vigneaud, SCIENCE, 91: 243, 1940.

answering them systematically, he was a great pioneer who led the way into new fields of investigation. He found anthropology a collection of wild guesses and a happy hunting ground for the romantic lover of primitive things; he left it a discipline in which theories could be tested and in which he had delimited possibilities from impossibilities.

The first general theoretical problem on which he worked was that of the importance of the diffusion of traits in human culture. It was necessary to show how each culture, however individual, is in reality one local variant of a far more wide-spread form. Ratzel, his teacher, had believed that this was due to direct influence of the geographic environment; orthodox scientific opinion more generally held that this was due to inevitable operations of the human psyche. He had to prove how constant and pervasive cultural borrowing was, not merely of useful inventions but of curious and even hampering ideas. The growth of human cultures, he demonstrated, had to be understood through a knowledge of the spread of inventions and institutions, whether they appear to us rational or irrational. It was the assembled documentation of this truth that led him to oppose the rational reconstructions of cultural evolutionists.

Historical reconstruction, with all its emphasis on diffusion of traits, never seemed to him separable from social processes which had to be studied in the flesh. He wanted to know as much about the revamping of a trait in a borrowing tribe as about the mere fact of borrowing. In his interest in this aspect of culture he wrote, as early as 1896 and 1904, discussions emphasizing the importance of cultural patterning; in his own words, how a tribe "in its setting among neighboring cultures builds up its own fabric." This problem was closely allied to those concerning the working of the culture, "by which I mean the life of the individual as controlled by culture and the effect of the individual upon culture." Though he had spent many years of his life on historical reconstruction, he recognized clearly that even if we could obtain complete knowledge of how a trait or an institution came into being, that knowledge would not help in the solution of these functional problems. Institutions "affect the individual and he affects them only *as they exist today*." In 1923 he said that "diffusion was won" and that as he saw it, anthropology should spend its energies answering these questions of the interplay of the individual and culture. He sent a generation of students to Samoa, to New Guinea, to Melanesia, to Africa, to South America and to the North American Indian to study the conditions brought to bear upon individuals by the cultural forms under which they lived.

His insistence on phrasing questions so that they could be answered by investigation and upon gathering first-hand material to answer them was of equal importance in his two other chosen fields of research: linguistics and physical anthropology. He is identified in the public mind with his research in race problems. He came to these problems from researches in the influence of environment upon growth, researches which he began while at Clark University, 1888–1892, and which were stimulated by G. Stanley Hall. "When I turned to the consideration of racial problems I was shocked by the formalism of the work." He set himself against the whole methodology of a "racial" heredity. "Heredity acts only in lines of direct descent. There is no unity of descent in any of the existing races." Especially during the last twenty years Boas constantly had on hand researches in race and in problems of growth, for he recognized the seeds of social catastrophe in the doctrines of the racialists and hoped that if their contentions were disproved it would lessen the danger. As late as 1937 he made the journey to Paris to the Congrès International de la Population to emphasize before a gathering largely dominated by Nazi racialists that social conditions are determinative even for those aspects of behavior usually assigned to "race."

His scientific writings were voluminous and are well represented in the volume of selected papers he edited in 1940, "Race, Language and Culture." His least technical volumes are "The Mind of Primitive Man," 1911; "Primitive Art," 1927; "Anthropology and Modern Life," 1928; and his contributions in "General Anthropology," 1938, which he planned and edited.

Boas' own personal researches are inextricably interwoven with work for which he supplied the inspiration, often arranged the financing and contributed counsel and editorial assistance. His work as editor alone would have been sufficient to fill the lifetime of an industrious man. To his classroom teaching also he gave his best. Until recent years most American anthropologists sat under him. As early as 1896 he began teaching physical anthropology and linguistics at Columbia University and in 1899 was made professor of anthropology there. He retired in 1936. Since then he has devoted himself to his researches and to his championing of social and political sanity. He was a great humanitarian and he believed in the social efficacy of the Golden Rule not merely in individual relations but between groups and between nations. He believed in civil liberties. For a man of Boas' integrity these convictions could not end in lip service; they meant to him taking strong positions about national and international affairs, about the

conduct of education and the organization of schools. During the last decade the fact that his motherland was being allowed to run amok in the civilized world touched him nearly and he feared that the democratic nations would never unite against the Nazi plan of world domination. But he saw always that anything that could be done to stop this menace, even war when the world had let slip all other methods, should be a means to the end of Germany's salvation as well as ours.

Boas received many honors. He was made a member of the National Academy of Sciences in 1900. In 1931 he was president of the American Association for the Advancement of Science. He received the Sc.D. from Oxford University and from Columbia and the LL.D. from Clark University. His alma mater, the University of Kiel, solved its dilemma by awarding an honorary M.D. because that at least he did not have. They were fitting honors to a man of Boas' tirelessness, of his integrity, of his sanity. It was not the honors, however, but these special qualities, so pervaded by his great intellectual powers, which made him one of the noblest representatives of his generation.

RUTH BENEDICT
COLUMBIA UNIVERSITY

RECENT DEATHS

DR. HOWARD A. KELLY, since 1919 emeritus professor of gynecology of the Medical School of the Johns Hopkins University, died on January 12. He would have been eighty-five years old on February 20. Mrs. Kelly died six hours later.

DR. CHARLES J. CHAMBERLAIN, since 1921 professor emeritus of botany of the University of Chicago, died on January 5 in his eightieth year.

DR. GEORGE WASHINGTON CRILE, surgeon, director of the research laboratories of the Cleveland Clinic Foundation, died on January 7. He was seventy-eight years old.

DR. AARON J. ROSANOFF, psychiatrist, formerly California state director of institutions, died on January 7, at the age of sixty-four years.

NIKOLA TESLA, the inventor, died on January 7, at the age of eighty-five years.

SCIENTIFIC EVENTS

ASSOCIATION OF UNIVERSITY PROFESSORS AND LECTURERS OF ALLIED COUNTRIES IN GREAT BRITAIN[1]

As the established bodies for intellectual collaboration were obliged to cease their work owing to the war, universities being in many cases closed down in the occupied countries by the invader, scholars, professors and lecturers from all over the world gradually made their way to England, where they now have their headquarters and are living and working in all parts of Great Britain.

This assemblage seemed to present a unique opportunity for men of mutual interests and intellect to come together and form an association. A few professors of different nationalities, headed by Professor Stefan Glaser, of Poland, decided to start an association, the aims of which are the reconstruction of universities in the occupied countries after the war, the development of an academic fraternity between allied university teachers and research workers now in Great Britain, the consideration of all academic problems both during the war and in the post-war period, collaboration with any other bodies which may have similar interests, the examination of problems referred to it by any of the Allied Governments or by any other appropriate official bodies.

The first general meeting was held on May 11, 1942. From the very first there was a great deal of interest and enthusiasm, and an organization was formed under the title of "Association of University Professors and Lecturers of Allied Countries in Great Britain." There are at present 225 members and twelve countries are represented, besides India and the British Dominions.

As the whole subject of post-war reconstruction and education is a long and very complex one, it was furthermore decided to get in touch and collaborate with other associations of similar interests. Contacts were made with the British Association for the Advancement of Science, the British Association of University Teachers and the American University Union. Several neutral countries, which may have representatives as guests, have been approached, and all the vice-chancellors of universities in Great Britain have been informed of the program of work.

Since the association has to deal with different domains and subjects, it was decided to form separate sections in order that members should be able to collaborate on subjects of mutual interest. There are at present twelve such sections:

(1) Contact and collaboration with British scholars; organization of lectures of Allied professors in Great Britain (*Provisional chairman*, Professor P. Vaucher).

(2) Collaboration with other international bodies; international research center in Great Britain; international review of science and learning (*Provisional chairman*, Professor J. Timmermans).

(3) Reconstruction of science and learning in the occupied countries (*Provisional chairman*, Professor S. Glaser).

[1] From *Nature*.

(4) Re-education of youth after the war and alleviation of moral damage; future collaboration (elaboration of common programs of teaching, improvement of existing programs, exchange of students and teachers, acknowledgment of Allied diplomas in Great Britain and so on); elaboration of main principles of the future social order; international university (*Provisional chairman,* Mr. Randall Lane).

(5) Law (*Provisional chairman,* Professor A. L. Goodhart).

(6) Science (*Provisional chairman,* Professor A. Photiades).

(7) Economy (*Provisional chairman,* Professor J. A. Veraart).

(8) Modern humanities (*Provisional chairman,* Professor L. Genissieux).

(9) History (*Provisional chairman,* Dr. Yuen-li Liang).

(10) Technical science and engineering.

(11) Medicine, as distinct from general science (*Provisional chairman,* Professor J. Skladal).

(12) Philosophy.

The executive committee consists of sixteen members, namely:

Belgium, Professor Jean Timmermans; *China,* Dr. Yuen-li Liang; *Czechoslovakia,* Professor Vladimir Klecanda; *France,* Professor René Cassin, Professor Paul Vaucher; *Great Britain,* Sir Alfred Zimmern, Professor B. Ifor Evans, Professor W. Entwistle, Professor R. Douglas Laurie; *Greece,* Professor Alexander Photiades; *Netherlands,* Professor J. A. Veraart; *Norway,* Professor A. Sommerfeit; *Poland,* Professor Stefan Glaser, Professor B. Helczynski; *United States of America,* Professor A. L. Goodhart; *Yugoslavia,* H.E. Professor Milam Grol.

The officers of the association and of the executive committee are: Professor Stefan Glaser (president); Professor Jean Timmermans (vice-president); Professor B. Ifor Evans (secretary-general); Professor Paul Vaucher (treasurer).

The second general meeting as well as a meeting of all sections took place on December 16 at the Rembrandt Hotel, Thurloe Place, S.W.7, at 4 P.M. Information concerning membership or details regarding the work and aims of the association can be obtained from the secretary for the association, 40 Queen's Gate, London, S.W.7.

INCOMES OF CHEMISTS

THE median annual income of members of the chemical profession in 1941 was $3,364, according to a survey just completed by the committee on economic status of the American Chemical Society, of which Dr. Lawrence W. Bass, of Boston, is chairman. Fifty per cent. of the profession earned more than this amount and 50 per cent. less. The survey is published in *Chemical and Engineering News.*

Twenty-five per cent. of the membership, as indicated by a cross-section of 77.6 per cent. of those queried, had annual incomes in excess of $4,943, while 10 per cent. earned more than $7,978. By contrast, annual incomes of less than $1,932 were reported by the lower one tenth of the membership, and of less than $2,498 by the lower one fourth. Ten per cent. of the members with forty years' experience exceeded $19,200 annually; 25 per cent. of these earned more than $9,694.

The survey, one of the most elaborate statistical studies ever made on the economic status of a group of professional men and women, covers a fifteen-year period, from 1926 to 1941, during which there were enormous fluctuations in both annual incomes and monthly salary rates.

In 1941 the annual incomes and monthly salary rates, when related to years of professional experience, were lower than those reported for 1926 and 1929. Analyses of monthly salary rates indicate that the earnings of younger members in 1941 were approaching the high rates of earnings in 1926 and 1929 at a much faster rate than those of older members.

The median income of those members who had just begun their professional careers in 1941 was $1,600 a year. At succeeding levels of experience annual median incomes steadily increased and reached a maximum of $5,818 a year for those members who in 1941 had been professionally active for thirty-five years. At approximately forty and forty-four years of professional experience the median incomes had declined to $5,500 and $4,800 a year, respectively.

After five years of professional experience 50 per cent. of the membership in 1941 was earning over $2,450 a year and 50 per cent. was earning less. The annual incomes of one fourth of this same group were $450 greater than the median or $2,900 a year; and another fourth earned $400 less than the median or $2,050 a year. Ten per cent. of the group earned $3,300 or more a year, while 10 per cent. were lower than the median by $750 or more, earning $1,700 a year.

With lengthening experience, the spread in annual incomes becomes accentuated, especially at the upper 10 per cent. and the upper 25 per cent. earnings levels. After ten years of experience, the median annual income reported in 1941 was $3,180 a year. One quarter of this group earned more than $3,800 a year, one quarter less than $2,600, one tenth more than $4,400 and one tenth less than $2,130.

After twenty years' experience, the median annual income was $4,650, while after thirty years' experience it was $5,550. At the upper 10 per cent. earnings level, however, members with thirty years' experience were earning more than $17,000, or nearly four times as much as members at this level with only ten years' experience. At the lower 10 per cent. earnings level, members who had been professionally active for thirty years reported annual incomes of $3,000.

TESTIMONIAL VOLUME FOR DR. GEORGE L. STREETER

DURING the period from 1917 to 1940 Volumes VIII to XXIX of the Contributions to Embryology of the Carnegie Institution of Washington were published under the editorship of Dr. George L. Streeter as part of his duties as director of the department of embryology. With self-effacing devotion, with adherence to the highest standards of technical perfection, and with the capacity to enlist skilled collaboration on the part of scientific contributors, illustrators, printers and engravers and the Office of Publications of the institution, he made this series a veritable treasury of embryological progress. Such, however, is its austere anonymity that nowhere in the twenty-two volumes can be found any mention of its editor by name.

The present staff of the department of embryology, with the approval of the president of the institution, has therefore dedicated Volume XXX, which appeared on December 31, 1942, to Dr. Streeter and has placed his portrait at the head of the volume.

It is a frequent custom, when such an achievement is to be honored, to assemble a testimonial volume or Festschrift of specially written articles. Dr. Streeter's colleagues have deliberately chosen, however, to convey their tribute by means of a regular volume of the series, prepared in the usual course of scientific research, thinking that in this way they best call attention to the fact that the whole series is a testimonial to Dr. Streeter. This particular volume represents, as it happens, workers of ten laboratories on three continents. Most of the investigations were carried out in the Carnegie Embryological Laboratory and all except one made use of its collections or other facilities. It is dedicated to Dr. Streeter in the name not only of the present contributors, but of all those investigators now scattered over the Americas, Europe and Asia—many of them unfortunately inaccessible or distracted by reason of the war—who have worked in this laboratory and published their results under his editorship.

Being a modest man, Dr. Streeter may be embarrassed by the fact that the volume thus dedicated to him contains an article of his own; but this too may be taken as testimony to his eminence as investigator as well as editor. After the successful completion of his editorship, he remains a valued contributor.

THE STAFF OF THE DEPARTMENT OF EMBRYOLOGY
CARNEGIE INSTITUTION OF WASHINGTON,
WOLFE AND MADISON STREETS,
BALTIMORE, MD.

THE NEW YORK MEETING OF THE AMERICAN PHYSICAL SOCIETY

THE two hundred and fifty-third meeting of the American Physical Society, postponed from December 28–30 on account of the congestion of the railroads during the holiday season, will be held at Columbia University, New York City, on Friday and Saturday, January 22 and 23. It will be designated "the annual meeting of 1942." The American Association of Physics Teachers and the American Society for X-Ray and Electron Diffraction, having likewise deferred their December meetings, will meet with the society. Registration and sessions will be held in the Pupin Physics Laboratories of the university, opening at 9:30 on Friday morning.

The council of the American Physical Society will meet at 8 P.M. on Thursday, January 21. A business meeting will be held on Saturday at 9 A.M., after which President P. W. Bridgman will deliver his presidential address. The annual dinner will be held on Friday evening at 6:15 at the Men's Faculty Club.

The Society for X-Ray and Electron Diffraction is the principal sponsor of the Saturday afternoon session, which will begin at two o'clock with an invited paper by Dr. P. Debye on "Recent Developments in X-Ray and Electron Diffraction." It will be followed by contributed ten-minute papers.

The Association of Physics Teachers will confer its Oersted Medal at 4:30 P.M. on Friday, and its Richtmyer Lecture by Dr. G. F. Hull, on "The New Spirit in American Physics," will be given at 5 P.M.

The annual Sigma Pi Sigma luncheon for members and guests of this organization is scheduled for Friday at 12:15 P.M., also at the Men's Faculty Club.

SCIENTIFIC NOTES AND NEWS

SIR HENRY DALE, president of the Royal Society, on December 20 laid a wreath on the grave of Sir Isaac Newton in Westminster Abbey to commemorate the tercentenary of his birth, which fell on Christmas Day.

THE Perkin Medal of the American Section of the Society of Chemical Industry was presented on January 8 to Dr. Robert E. Wilson, president of the Pan American Petroleum and Transport Company, in recognition of outstanding industrial researches. The medal was presented by Dr. Marston T. Bogert, professor emeritus of chemistry of Columbia University, at a joint meeting of the society, the New York Section of the American Chemical Society, the American Institute of Chemical Engineers, the Electrochemical Society and the Société de Chimie Industrielle.

THE John Jeffries award "for outstanding contributions to the advancement of aeronautics through

medical research" of the Institute of the Aeronautical Sciences will be presented to Dr. Edward C. Schneider, professor of biology at Wesleyan University, at the honors night dinner of the institute to be held in New York on January 26.

THE Van Meter Prize of the American Association for the Study of Goiter has been awarded to Walter Mann, research fellow in radiology, and Charles P. Leblond, of the University of Rochester School of Medicine and Dentistry, New York, for their essay on "Chemical Transformation of the Iodine Fixed by the Thyroid Gland."

THE Swedish Medical Society of Stockholm has presented to Dr. Alfred Vogt, professor of ophthalmology at Zurich, the Gullstrand Medal, which is awarded every ten years to an eminent ophthalmologist.

PROFESSOR H. MOOSER, director of the Institute of Hygiene of the University of Zurich, has been elected an honorary member of the Royal Academy of Medicine of Barcelona for his researches on typhus fever recently made in Spain.

DR. HEBBEL E. HOFF, formerly associate professor of physiology at the Yale University School of Medicine, has been appointed professor of physiology at McGill University. He assumed his work there on December 1.

DR. G. A. R. KON, reader in organic chemistry at the Imperial College of Science and Technology, London, has been appointed the first incumbent of the University of London chair of chemistry tenable at the Royal Cancer Hospital, which was instituted just before the outbreak of war.

WALTER J. MURPHY, of New York, editor and general manager of *Chemical Industries,* has been appointed to succeed the late Harrison E. Howe as editor of *Industrial and Engineering Chemistry* and *Chemical and Engineering News,* publications of the American Chemical Society. The appointment was made by the board of directors, unanimously concurring in the recommendation of the executive committee of the society. Mr. Murphy also becomes director of the News Service. He will assume his new work on February 1.

DR. SHEFFIELD A. NEAVE, of the Imperial Institute of Entomology, editor of "Nomenclature Zoologicus," has been appointed honorary secretary of the Zoological Society of London, in succession to Dr. Julian Huxley, resigned.

DR. NORMAN FENTON, professor of education at Stanford University, has been appointed consultant in mental hygiene and delinquency prevention by the California Youth Correction Authority. He was formerly director of the Bureau of Juvenile Research in California.

DR. F. F. LININGER has been appointed as of October 1 director of the Experiment Station of the Pennsylvania State College. Dr. S. W. Fletcher, dean of the School of Agriculture, will continue as its chief executive officer in charge of instruction, research and extension.

DR. BRET RATNER, clinical professor of pediatrics at the College of Medicine of New York University, has been appointed visiting pediatrician and director of pediatrics at the Sea View Hospital, N. Y. Dr. Bela Schick, the former chief of the service, retired recently. He is now consultant pediatrician.

DR. ERNEST G. LION, instructor in psychiatry at the School of Medicine of Stanford University, has been chosen director of a new psychiatric clinic designed to rehabilitate and reorient borderline cases of feminine delinquency. The clinic has been established by the U. S. Public Health Service and the San Francisco Department of Public Health, and is said to be the first of its kind in the United States.

CLIFFORD C. GREGG, director of Field Museum of Natural History, Chicago, who for some time past has been on leave of absence for service as assistant chief of staff, G. I. (Personnel), in the U. S. Army, has been promoted from the rank of Lieutenant Colonel to Colonel.

ELIOT C. WILLIAMS, JR., assistant to the director of the Chicago Academy of Science, who has been serving in the Army Medical Corps, has been transferred to the Chemical Warfare Branch of the service and is now a cadet in officers' training.

DONALD M. HATFIELD, curator of mammals at the Chicago Academy of Sciences, has been granted leave of absence to accept a position with the Kaiser Shipyards at Richmond, Calif. He will be engaged in the production of motion pictures and slide-films to be used in a program of visual training.

THE Committee on Scientific Research of the American Medical Association has made the following grants: to Roger M. Reinecke, University of Minnesota, for work on carbohydrate metabolism of the kidney; to Oliver P. Jones, University of Buffalo, for work on erythropoietic action of extract of the human stomach, and to Ulrich Friedemann, Jewish Hospital, Brooklyn, for work on types of tetanus toxin.

DR. FULLER ALBRIGHT, assistant professor of medicine at the Harvard Medical School, will deliver the fourth Harvey Society Lecture of the current series at the New York Academy of Medicine on January

21. His subject will be "Studies on the Pathological Physiology of Cushing's Syndrome."

DR. KARL F. MEYER, professor of bacteriology and director of the Hooper Foundation for Medical Research in San Francisco, is giving at Tulane University a series of lectures on tropical medicine with particular emphasis on the laboratory diagnosis, pathology, clinical aspects and prevention of tropical diseases.

DR. HENRY GILMAN, professor of chemistry at Iowa State College, is giving a three weeks' series of lectures at the National University of Mexico, at the invitation of Professor Ricardo Monges Lopes, director of of the Faculty of Sciences.

DR. E. D. ADRIAN, professor of physiology at the University of Cambridge, will deliver the Sharpey-Schafer memorial lecture of the University of Edinburgh for 1943.

DR. C. D. DARLINGTON, director of the John Innes Horticultural Institution, will deliver lectures to the Mendelian Society of Lund, Sweden, under the auspices of the British Council. In addition, he will lecture on cytology and will give a number of general lectures on biological topics before learned societies in other centers.

DR. WILBER E. POST will deliver the presidential address at the postponed twenty-seventh annual meeting of the Institute of Medicine of Chicago, on Friday evening, January 22. His subject will be "Problems and Progress in Bright's Disease over a Period of Forty Years from the Viewpoint of a Clinician."

IT is announced that requests to the National Research Council Committee for Research in Endocrinology for aid during the fiscal period from July 1, 1943, to June 30, 1944, will be received until February 28. Application blanks may be obtained by addressing the Division of Medical Sciences, National Research Council, 2101 Constitution Avenue, Washington, D. C. In addition to a statement of the problems and research plan or program, the committee desires information regarding the proposed method of attack, the institutional support of the investigation and the uses to be made of the sum requested. No part of any grant may be used by the recipient institution for administrative expenses. Applications for aid of endocrine research on problems of sex in the narrower sense can not be given favorable consideration, but the committee will consider support of studies on the effects of sex hormones on non-sexual functions, *e.g.*, on metabolism.

THE University of Glasgow has received from Fred H. Young, a Glasgow carpet manufacturer, the sum of £22,000 to endow a lectureship in orthopedics in the department of the Regius professor of surgery.

SYRACUSE UNIVERSITY received more than $240,000 from various gifts, grants and bequests, added some $70,000 to its general endowment, and showed a small operating surplus during the past fiscal year, according to the annual report of George E. Van Dyke, university treasurer. Receipts amounted to more than $4,111,000, of which $2,195,000 or about 53 per cent. came from student fees. Expenditures were more than $4,054,000, the largest item of $1,450,000 being for instruction. The average cost to the university per student was estimated by Mr. Van Dyke at $680, as compared to the annual tuition charge of $400. Although the current fund deficit stands at $200,000, the figure represents a reduction of $150,000, achieved by the annual operating surpluses during the past six years. The operating surplus for the past fiscal year was $57,000.

Nature reports that the estate of Sir Joseph Larmor, who died on May 19, amounts to £54,500. He made the following bequests, among others: £3,000 to St. John's College, Cambridge, for annual awards for undergraduates; £3,000 to the Royal Academical Institution, Belfast, to supplement scholarships; £3,000 to augment emoluments held by junior members in Northern Ireland of Queen's University, Belfast; £2,000 to the University of Cambridge to provide medical and other assistance to junior members of the university; £1,000 each to St. John's College, Cambridge, and Magee University College, Londonderry; and £750 each to Trinity College, Dublin, and the National University of Ireland for the benefit of University College, Galway. Subject to other bequests, the residue is to be used for increasing the educational bequests to St. John's College, Cambridge, the Royal Belfast Academical Institution and Queen's University, Belfast.

GOVERNOR PRENTICE COOPER of Tennessee has announced a cooperative agreement between the State Division of Forestry and the U. S. Forest Service to help farmers to produce more mature timber and to receive a fair price for it. Under the terms of the agreement the Federal Government will contribute $7,650 a year, which will be matched by the state. The money will be used to employ five technically trained foresters to assist Tennessee farmers to manage their woodlands and market their timber.

The Experiment Station Record states that, according to an announcement by Russian War Relief, Incorporated, a shipment by airplane of new varieties of disease-resistant seeds contributed by experiment stations in the United States and Canada has been received in Moscow by the Lenin All-Union Academy of Agricultural Sciences. The shipment includes the more familiar grains and vegetables of Russia—wheat, oats, barley, tomatoes, carrots, beets, cucumbers, cab-

bage and corn—and a few vegetables hitherto little cultivated there—spinach, collards, celery, peas, squash and eggplant. The stations accredited with the various seeds are as follows: California, Connecticut (New Haven), Indiana, Kansas, Massachusetts, Michigan, Minnesota, New Jersey (New York), Cornell, Ohio, Tennessee, Virginia Truck, Washington, Wisconsin and Saskatchewan.

DISCUSSION

WHEN A COMMITTEE VOTES BY MAIL

WHEN it is necessary for a committee to consider a question and render a report without holding a meeting, a vote of the members may be taken by mail. Excepting for questions with the analysis of which all committee members are surely already well acquainted, a satisfactory decision by mail vote is difficult unless special precautions are first taken to make sure that every member has ample opportunity to express his own ideas and to consider ideas that may be expressed by others of the group. Only in such manner can a mail vote be democratically based on free discussion comparable to the discussion that usually precedes a vote taken at an actual meeting, when all members express themselves orally. Because meetings of committees representing scientific organizations in wartime are likely to involve unwonted difficulties of time and travel, votes by mail may now be resorted to more frequently than in recent years. It is therefore timely to consider ways and means by which this form of voting may be best employed. The following suggested plan of procedure involves some ideas expressed in SCIENCE for May 13, 1913, by Dr. Edward C. Pickering, a former chairman of the Executive Committee of the American Association. This plan was approved in principle by the Executive Committee of the American Association at its meeting on October 17, 1942.

(1) A mail ballot may have been authorized by the committee at an actual meeting or may be called for by any member at any time. A suitable memorandum concerning the question or questions to be considered is to be sent by the chairman to every member, with the request that each member shall reply promptly by (a) registering his approval or disapproval of the taking of the proposed mail ballot, also (b) presenting a preliminary statement of his views and (c) registering his vote on the memorandum if he wishes to do so at once.

(2) If a majority of the members vote against taking the proposed mail ballot, the chairman is to announce the adverse decision by means of a second communication to all members and the memorandum, together with the responses thereto, are to be placed on record for oral consideration at the next following session of the committee.

(3) If a majority of the members approve of taking the proposed mail ballot, and if the votes on the memorandum are decisive, the chairman's second communication to members is to be a minute of the action thus taken, announcing approval of the ballot and the resulting decision.

(4) If a majority of the members approve of taking the proposed mail ballot, but if the votes on the memorandum are not decisive, then the chairman's second communication to members is to announce approval of the ballot, at the same time transmitting to each member copies or abstracts of all preliminary statements received from members, with the request that each shall reply promptly by registering his vote for or against the question or questions proposed in the memorandum.

(5) If the votes received in response to this second communication show a majority of the members to be in essential agreement, a third communication from the chairman is to be a minute of the action thus taken. Otherwise, the third communication is to announce that no decision is indicated, and all papers concerning the question or questions involved are to be placed on record for oral consideration at the next following session of the committee.

(6) Actions taken by mail ballot are to become effective immediately unless otherwise provided, and minutes thereof are to be reported at the next following session of the committee.

(7) If any two members should be dissatisfied with the chairman's interpretation of the result of a mail ballot they may unite in calling for a repetition of the ballot, furnishing a suitable memorandum therefor, and the repetition is to be carried out as indicated above.

BURTON E. LIVINGSTON,
Chairman, Executive Committee, American Association for the Advancement of Science

SPELLING OF THE ADJECTIVE "HYPOPHYSEAL"

THE following comment was prepared in answer to a request for an opinion from the editors of a prominent scientific journal.

The word "hypophysis" was first used in English to indicate the pituitary gland, about the middle of the nineteenth century; its adjectival form did not appear in Webster's dictionary until the revision of 1890.

The words "apophysis" and "epiphysis," formed from the same root, were however used in English early in the eighteenth century. At first they were commonly written in the French spelling, *apophyse* and *epiphyse*.

The root word, "physis" came into English from the Greek much earlier, in the adjectival form "physic"; but this became a noun and a verb and is now rare as an adjective, so that the present adjectival form is "physical." It seems that by the time the words apophysis, epiphysis and hypophysis were introduced into our language, the words physic and physical had acquired such special connotations that "apophysic" or "apophysical," etc., would not have been clear. These words therefore took adjectival forms according to another standard method by which English adjectives are formed from certain Greek words, namely by adding the suffix -al, making apophysial, epiphysial, hypophysial. This is the only form and the only spelling which has ever been accepted by the lexicographers of England.

In the 1864 revision of Webster, however, epiphyseal appears before epiphysial; in the revision of 1909 apophyseal enters the lists; in the current (1934) revision hypophyseal appears, and the spelling with -eal is preferred in all three cases. There is admittedly no philological defense for this spelling. The suffix -eal is not English; words like lacteal, osteal, have the e in their roots, not in the suffix. Evidently, however, Webster has recorded a trend in the American spelling of these words, which began to show itself by 1864, influencing first the then most commonly used of the three terms, later overtaking the others.

Why have American lexicographers, following our biologists and physicians, introduced an aberrant spelling? Possibly "epiphyseal" goes back to the days when the noun was often written "epiphyse," or possibly some writers thought it was advisable to make the adjectives from the genitives of the Greek nouns (*e.g., epiphyseos, hypophyseos*).

Much more likely, however, the spelling has been influenced by an American trend in the pronunciation. All the dictionaries, British and American, place the primary accent invariably on the third syllable, *e. g.,* hypophýsial. At the present time (and as far as my observation goes, for decades past) American speakers almost universally place the primary accent on the fourth syllable, *e.g.,* hypophyséal, with a secondary accent on the second syllable. This has the practical advantage that the spoken adjective clearly suggests the noun, thus avoiding the mental effort of associating the dissimilar sounds "hypo-fizzial" and "hy-poffy-sis." The shift in pronunciation is, I believe, helpful, inevitable and permanent. Webster and the other dictionaries have simply not caught up with it.

Returning to the question of spelling, it is clear that "hypophyseal" suggests the current pronunciation, while "hypophysial" does not, for *i* before *a* is commonly short and unaccented. In spite of the fact that "-eal" is philologically irregular, I make bold to suggest that it be adopted as standard in American scientific writing, to the exclusion of the form in "-ial," in conformity with our well-nigh general pronunciation of the three words in question. At the price of a trifling deviation from one of the usual habits of word formation in English, too small to have troubled the careful lexicographers of Webster's staff these eighty years past, we choose the clearer, more phonetic form. Recognition of the current pronunciation by the dictionaries will no doubt promptly follow.

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THE UTILIZATION OF SCIENTIFIC RESOURCES

DR. THEODOR ROSEBURY, in the December 25, 1942, issue of SCIENCE voices a plea for the fuller utilization of scientific resources for total war with which every scientist can be in hearty accord. It is not clear, however, what Dr. Rosebury means when he speaks of chemists as on a "business as usual" basis. Perhaps the clue lies in his entirely erroneous statement that "more complete use has been found in war work for physical chemists than for those in other categories." By war work he may be thinking mainly of the development of new methods and new techniques such as those for detecting airplanes, submarines, and the like. As a matter of fact, the great majority of the seventy thousand chemists and chemical engineers in the United States are actively engaged in war work, mostly along the well-established lines of mass production of everything which the armed forces will need. This includes literally everything which they use either directly or indirectly in the war. Moreover, it includes adequate support of the civilian production army upon which the armed forces must depend. In addition, it includes a steady flow of chemically trained men and women to fill the expanding ranks of the technical production army.

The fact is that all industrial units can be divided into three categories. Each of these requires more chemical service in wartime than in peacetime. The first group consists of units which have always made materials directly useful in war such as T.N.T. and armor plate. They are expanded at least a hundred fold and need largely increased technical staffs, in-

cluding chemists. A second group consists of units which normally fill necessary civilian needs which continue during war and which are shared by the armed forces. Such are the groups producing food. Their problems are multiplied and intensified because of the war. This group of industries also needs more chemists than in peacetime. The third group consists of those producing goods which are essential neither to the armed forces nor to the civilian production army. Such units have already largely shifted over to war work. This shift is continuing at an increasing rate. Here again the need for technical help, especially of a chemical nature, is increased many fold. For instance, a peacetime company making ten-cent automatic pencils probably needs a minimum of chemical help. On the other hand, when it shifts over to making machine gun parts it certainly can not get along with less help of this kind.

Whenever we do find a chemist doing "business as usual" it is not something which we have to "tolerate" but something for which we can be thankful. This is because of the fact that, as a nation, we are hardly more than ten per cent. into total war. As we get fully into the war effort we shall need more chemists than can possibly be found or produced. Thus, the few chemists who are not yet fully in the war effort constitute our only chemical reserve. It is indeed too bad that this reserve is so small.

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d-TUBOCURARINE CHLORIDE AND CHOLINE ESTERASE

MANY have reported inhibition of choline-esterase by crude curare preparations, and recently Harris and Harris[1] have found that 0.016 mg of a partially purified curare preparation[2] will inhibit 85 per cent. of the choline-esterase activity of 0.5 cc of human serum. All preparations of impure curare, including "Intocostrin," examined in this laboratory were found to possess this choline-esterase inhibitory property. However, our recent experiments have shown that the chemically pure substance d-tubocurarine chloride is devoid of inhibitory action upon the choline-esterase activity of dog serum. It was found that 0.866 mg of d-tubocurarine chloride injected into the femoral artery of a barbital anesthetized 10 kilogram dog caused the complete curarization of the skeletal musculature. There was no change in blood pressure. *In vitro* experiments using concentrations of d-tubocurarine chloride up to approximately 29,000 times the calculated concentrations used in the *in vivo* experiments were entirely without inhibitory activity upon choline-esterase activity of dog serum. From these experiments it appears that the curare-action and the effects upon choline-esterase of the impure preparations of curare are not necessarily related.

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SPECIAL CORRESPONDENCE

ODE ON NEWTON'S THEORY OF GRAVITATION BY EDMOND HALLEY

WHEN Newton opened the printed copy of the first edition of the "Principia" in 1687, he found prefixed to the text a poem dedicated to his work and signed "Edm. Halley." It was at Halley's urging that the book had been written, and Halley had seen it through the press and paid the expenses of publication. He was then thirty years of age, Newton forty-four. The poem was in Latin like the Principia itself. It consisted of forty-eight hexameters; apart from its dedication, it bore no title.

The verses were reprinted in the second edition of the "Principia" (1713), which was edited by Roger Cotes, the mathematician, and seen through the press by Richard Bentley, the classical scholar. Bentley, without Halley's consent, altered some of the lines and omitted others. In the third edition (1726), edited by Henry Pemberton, a physician and scientist, Halley's original text was restored in most places; but a few of Bentley's changes were retained and some additional ones introduced. This text, like that of the second edition, did not meet with Halley's approval.

No further edition of the "Principia" appeared during the lifetime of Newton, who died in 1727. Both Halley and Bentley died in 1742; so that the two hundredth anniversaries of their deaths coincide approximately with the three hundredth of the birth of Newton and the death of Galileo, and the four hundredth of the death of Copernicus.

The text of all three editions of Halley's poem is printed in Stephen Peter Rigaud's "Historical Essay on the First Publication of Sir Isaac Newton's Principia," Oxford, 1838 (pages 57–59); in Sir David Brewster's "Memoirs of the Life, Writings and Discoveries of Sir Isaac Newton," two volumes, Edinburgh, 1855 (volume 1, pages 457–459); and in Eugene Fairfield MacPike's "Correspondence and Papers of Edmond Halley," Oxford, 1932 (pages 203–206).

[1] *Proc. Soc. Exp. Biol. and Med.*, 46: 619, 1941.

[2] Intocostrin. There is no evidence that the choline-esterase inhibitory activity of Intocostrin constitutes a clinical hazard.

In the following translation, made in 1923 but not hitherto published, I have used Halley's original text and have tried to follow it closely.

ALEXANDER WEINSTEIN

ZOOLOGICAL LABORATORY,
COLUMBIA UNIVERSITY

TO
THIS MATHEMATICO-PHYSICAL WORK
OF THE ILLUSTRIOUS
MR. ISAAC NEWTON,
AN ACHIEVEMENT WHICH IS
THE GREATEST GLORY OF OUR AGE AND NATION

Lo! the laws that govern matter and the motions of the skies,
The Creator's computations are revealed before our eyes.
Laws that God refused to violate at creation, when his hand
Fixed them as the world's foundations, that for eons it might stand.
Now the vault of heaven discloses what its inmost mysteries are,
What the far-flung force that rotates even the most distant star.

Throned amid celestial orbs, the Sun commands them all to swerve
Toward himself, and every planet swings around him in a curve.
Every rectilinear motion is deflected by his force.
Now at last we know the secret of the Comet's curving course,
And no longer will the bearded star inspire our hearts with fear.
Now the wanderings of the silver Moon at last are rendered clear:
Why her paces are unequal, why she never would submit
To be bridled by the numbers, to be guided by the bit
That astronomers have wrought for her; we gather at a glance
Why the nodes are retrograding, why the apsides advance.
We can gauge the force with which the Moon pulls on the ebbing sea
When the broken waves, recoiling, leave the kelps and sedges free
And disclose, to watchful sailors, sands and shallows; till once more
Turning back, the heaving ocean beats and breaks upon the shore.

Cryptic questions that perplexed the mind of many an ancient sage,
Riddles over whose solution fruitless controversies rage,
We can read their answers plainly. Mathematics puts to rout
All the error that oppressed us, and the darkness and the doubt;
For the wisdom of a genius has enabled us to rise
To the mansions of the mighty gods, to scale the lofty skies.

Leave your earthly cares, O mortals; here are wider views to scan.
See how far above brute cattle is the wondrous mind of man—
Sprung from heaven, it can compass cosmic truths. And even he
Who, by written tablets, outlawed murder, theft, adultery,
And the bearing of false witness—though he guided men aright,
Did not elevate the human race to such a lofty height.
Nor did he who first prevailed on wandering tribes to settle down
And to build them habitations in a wall-encircled town.
No, nor he who blessed mankind by teaching it to till the soil;
Or who pressed from juicy grapes the antidote to care and toil;
Or who used the reeds along the Nile for writing, having found
How to make a pictured symbol represent a spoken sound.
Those discoveries brought some solace to the race of men who bow
Underneath the heavy burden of life's miseries. But now—
Now at last we are admitted to the great gods' banquet hall;
Now we traverse all the heavens, and we probe this earthly ball
For the secrets locked within it; now we contemplate the vast
Changeless order of the universe unknown in ages past.

You who take delight in nectar and in heaven's ambrosial fare,
Sing with me the praise of him who laid the scheme of Nature bare—
Newton, who unlocked the treasury where Truth lay hid from sight;
Newton, loved of all the Muses; Newton, whom the god of light,
Phoebus, fires with inspiration. No unworthy thought can win,
No base passion stir his bosom. There the god has entered in,
And his holy presence fills the mind that sees the cosmos plain.
Nearer to immortal godhead mortal man may not attain.

SCIENTIFIC BOOKS

QUALITATIVE ANALYSIS

Semi-micro Qualitative Analysis. By PAUL ARTHUR and OTTO M. SMITH. xi + 322 pp. 28 figs. 15.2 × 22.7 cm. New York and London: McGraw-Hill Book Company. 1942. $2.75.

Semi-micro Qualitative Analysis. (The Barber Pres-

sure Bulb Method.) By HERVEY H. BARBER and T. IVAN TAYLOR. xvi + 446 pp. 2 plates. 54 figs. 15.4 × 23.5 cm. New York and London: Harper and Bros. 1942. $3.50.

Introduction to Semimicro Qualitative Analysis. LOUIS J. CURTMAN. x + 377 pp. 2 plates, 39 figs. 14.2 × 21.3 cm. New York: The Macmillan Company. 1942. $2.75.

IT is the trend of the times for text-books of qualitative analysis to include more and more of the material which, not so many years ago, was an important part of the subject-matter of courses in physical chemistry. No one will question the desirability of introducing the student at the earliest possible moment to the concepts of chemical equilibrium and the theory of solutions, and it is evident that the study of qualitative analysis provides an excellent opportunity to illustrate these principles, as well as many others. But the result of this trend, as exemplified by the volumes under consideration, seems to this reviewer to have reached the point where theory has begun to encroach upon the fair claims to attention of the analysis itself.

Even in the least ambitious of the texts under review (so much so that the problem of anion interference with cation group tests is not considered at all) the theoretical section comprises three fifths of the book and includes, in addition to the usual topics, such matters as mathematical treatment of buffer solutions, coprecipitation phenomena, etc. The student who absorbs all the material in the most ambitious of these books will have mastered the equations of Stokes and of Poiseuille, the experimental arrangements for measuring specific conductance and much more. The utility of all this information is beyond question, but its inclusion in the qualitative analysis course is a question which must be decided by each teacher on the basis of what his students have already learned, and what they expect to learn in subsequent courses.

"Semi-micro Qualitative Analysis," by Arthur and Smith, is concise, with few novel features. The theoretical section is extensive in comparison with the somewhat abbreviated scope of the analytical scheme which is followed, but is understandable and amply provided with excellent review questions and problems at the end of each section. The Debye-Hückel theory and the Brønsted system are briefly described but are not actively employed in the text. A conventional semi-micro scheme of analysis is followed, employing only the two or three customary organic reagents. The space devoted to discussion of the anions is very limited, although more than two dozen are nominally included. The consistent use of the plural "equilibriums" and the misspelling of Brønsted everywhere except in the Preface, are minor flaws together with which some may reckon the choice of the highly glazed paper on which the book is printed.

"Semi-micro Qualitative Analysis," by Barber and Taylor, is by far the most attractive of the three texts under discussion, as well as the one with the most original and distinctive features. Of the novelties the most significant is the adoption of the pressure bulb method of Barber (*Ind. Eng. Chem., Anal. Ed.*, 12: 58, 1940) for separating precipitates and filtrates without use of the centrifuge. The practicability of this method is no less evident than is its versatility—the pressure bulb is also employed in suction filtration and in drawing gases through reagents, etc.—but its general desirability can be determined only after lengthy experience in the undergraduate laboratory.

To match this promising innovation the authors have introduced the use of no less than 35 organic reagents, mostly as the basis of confirmatory tests, but with a substantial number contributing to group or other separations, such as the use of butyl cellosolve to dissolve the more ionic strontium nitrate, leaving calcium nitrate. Wherever possible the authors have sought to emphasize the principles involved, as well as the results obtained, in the use of these organic reagents. However, such extensive use of reactions with which the second-year chemistry student can not possibly be familiar seems to this reviewer to be of doubtful pedagogic value. On the other hand, the indicator control of pH in the various precipitations is a highly commendable feature.

The extent of the very modern theoretical sections has been indicated above. They are clearly presented and readable. The treatment of pH, as well as of oxidation-reduction equations, is especially noteworthy. Good review questions are provided.

The last section of the book consists of 27 pages of reference tables of the reactions of ions and their compounds, arranged in the most informative manner this reviewer has yet seen. Praise is also due the exhaustive index and the fine typography. Granted a course in qualitative analysis of the scope envisaged by the authors, it should be a pleasure to use this book.

"Introduction to Semi-micro Qualitative Chemical Analysis," by Curtman, possesses many of the features introduced in earlier texts by this author, and now adapted to the semi-micro scale. The use of potassium hydroxide to separate the subdivisions of the copper-tin group is retained, as well as the separate precipitation of quinquevalent arsenic subsequent to the copper group procedure. Only the most

indispensable organic reagents are employed. Another highly creditable feature is the emphasis on the qualitative chemistry of the anions, which are all too frequently neglected.

The purely theoretical section comprising slightly more than one third of the book while generally adequate does not seem either attractive or particularly thorough. Amphoterism is scantily treated, though not to the extreme degree that its omission from the index would indicate (three rather random references are given under Ampholytes, but this term is not used consistently throughout the book). One of the virtues of the theoretical section is the abundant selection of good numerical problems.

Numerous photographs and line drawings of apparatus and manipulative procedure are a decided asset, but the rather crowded analytical instructions and unattractive format are not.

WENDELL H. TAYLOR

PRINCETON UNIVERSITY

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

FINANCIAL REPORTS

TREASURER'S REPORT

Balance Sheet—Assets at September 30, 1942

Securities and mortgages	$193,371.67
Cash awaiting investment	64,892.46
Cash for current needs	14,769.24
Total assets	$273,033.37

Balance Sheet—Liabilities at September 30, 1942

Endowment—for research (1)	$118,811.45
Endowment—for general purposes (2)	92,097.88
Endowment—dues for emeritus life members (3)	5,000.00
Endowment—dues for emeritus annual members (4)	500.00
Reserve fund	41,854.80
Prize fund	2,000.00
Unpaid grants to affiliated academies	1,027.00
Accumulated income available for appropriation	11,742.24
Total liabilities	$273,033.37

(1) Richard T. Colburn fund, $87,186.45; fees of deceased sustaining members, $7,000; fees of deceased life members, $21,100; A. G. Stillhamer fund, $3,525.

(2) W. Hudson Stephens fund, $4,381.21; Michael P. Rich fund, $10,000; Hector E. Maiben fund, $27,357.67; Friends of the Association, $3,559; Jennie M. Arms-Sheldon, $1,000; fees of living life members, $45,800.

(3) Jane M. Smith fund, $5,000.

(4) Luella A. Owen fund, $500.

CASH STATEMENT

Receipts

Balance, September 30, 1942	$136,019.22
Life membership fees	1,700.00
Grant returned, gift of grant, miscellaneous	135.00
Contribution to Prize Fund	1,000.00
Sale and redemption of securities	45,488.46
Accumulated interest during fiscal year	4,984.27
Total receipts	$189,326.95

Disbursements

Securities purchased	$ 89,023.25
Grants-in-aid of research	1,791.89
Grants to affiliated academies	1,858.50
For new emeritus life members	600.00
For emeritus annual members	24.00
Life members' journal subscriptions	1,617.00
Fifty-year members' journal subscriptions	75.00
Thousand Dollar annual prize	1,000.00
Miscellaneous expenses	90.38
Transfer of Permanent Secretary's Reserve to Permanent Secretary's account	13,585.23
Total disbursements	$109,665.25
Cash on hand, September 30, 1942	79,661.70
	$189,326.95

PERMANENT SECRETARY'S REPORT

Balance Sheet—Assets at September 30, 1942

Cash in banks	$ 37,711.29
Accounts receivable	113.78
Supplies and postage	2,001.11
Deferred charges	1,124.32
Total assets	$ 40,950.50

Balance Sheet—[illegible]ber 30, 1942

Advance payments	$ 1,008.60
Permanent Secretary's Reserve	37,711.29
Balancing account	2,230.61
Total liabilities	$ 40,950.50

INCOME [illegible]

for the [illegible]al Year [illegible]y grapevine September 30, 1942

Annual dues and fees	$108,442.75
Interest on bank account	440.38
Miscellaneous receipts	1,721.73
Registration fees—Dallas meeting	1,849.00
Receipts from Dallas Exhibition	3,287.00
Total income	$115,740.86

Expenses

Subscriptions to journals, including foreign postage	$ 66,709.36
Expenses of Washington office	24,723.50
Expenses of General Secretary	391.45
A.A.A.S. Bulletin (7 issues)	2,140.09
Allowances to Pacific and Southwestern Divisions	2,840.00
Circularizing for new members	7,550.54
Miscellaneous expenses	1,011.18
Expenses—Durham meeting (late charges)	31.25
Expenses—Chicago meeting (late charges)	279.80
General and travel expenses—Dallas meeting	5,044.05
Expenses of Dallas Exhibition	2,626.63
Total expenses	113,347.85
Balance	2,393.01
	$115,740.86

STATUS OF MEMBERSHIP

September 30, 1942, and September 30, 1941

	September 30, 1942	September 30, 1941
Sustaining members	0	0
Life members	534	539
Fifty-year members	24	25
Annual members, paid-up	21,366	19,692
Total in good standing	21,924	20,256
Members in arrears, 1 year	1,087	993
Members in arrears, 2 years	660	549
Total enrolment	23,671	21,798
Gains		
Reinstatements	26	27
New members	3,252	1,883
	3,278	1,910
Losses		
Resignations	637	518
Deaths	219	177
Dropped for nonpayment of dues	549	484
	1,405	1,179
Net gain in enrolment	1,873	731

SPECIAL ARTICLES

p-AMINOBENZOIC ACID DETOXICATION OF CARBARSONE (p-CARBAMINO PHENYL ARSONIC ACID) AND CERTAIN OTHER PENTAVALENT PHENYL ARSONATES ADMINISTERED IN MASSIVE DOSES TO RATS[1]

UNPUBLISHED studies pursued in our laboratory during the past two years have revealed that carbarsone, a drug widely used in the treatment of amebiasis, possesses trypanocidal properties, especially against *Trypanosoma equiperdum*.

In view of (a) the remarkable inhibition of the bactericidal[2,3] and malariacidal[4,5] action of certain sulfonamide drugs by the chemically similarly constituted *p*-aminobenzoic acid and (b) the fact that carbarsone possesses a *p*-amino phenyl group, it was of interest to determine what inhibitory effect, if any, *p*-aminobenzoic acid might exert on the trypanocidal action of carbarsone.

In order to avoid masking any minimal effects, both high and low doses of carbarsone that previous experience had shown to be effective in clearing the blood stream of trypanosomes were given, with and without the addition of *p*-aminobenzoic acid, to a series of infected rats. Two groups of control rats were set up: (1) infected rats receiving *p*-aminobenzoic acid alone and (2) uninfected rats receiving a high dose of carbarsone alone. In this preliminary experiment no inhibition of trypanosome multiplication was detected in the rats that received *p*-aminobenzoic acid alone. In those rats that received the smaller doses of carbarsone plus *p*-aminobenzoic acid, the trypanosomes, after disappearing from the blood stream, eventually reappeared, the animals finally dying of the disease. It was particularly interesting to note that the majority of rats that had received the high doses of carbarsone plus *p*-aminobenzoic acid survived; on the other hand, a large proportion of the controls, *i.e.*, rats which received the same high dose of carbarsone without the addition of *p*-aminobenzoic acid, died.

From this experiment two tentative deductions were drawn: (1) that *p*-aminobenzoic acid does not inhibit the trypanocidal action of carbarsone, and (2)

TABLE 1

PROTECTION OF RATS AGAINST CERTAIN ORGANIC ARSENICALS BY *p*-AMINOBENZOIC ACID

Drug dose and mode of administration	Dose of *p*-aminobenzoic acid and frequency of administration	Number of rats used	Number of rats surviving	Percentage survival + *p*-aminobenzoic acid	Percentage survival Control
*carbarsone**					
1000 mg/kilo i.m.	1 gm/kilo × 6 days	10	10	100	
"	controls	10	1		10
1000 mg/kilo i.v.	1 gm/kilo × 3 days	10	8	80	
"	controls	11	1		9
1500 mg/kilo i.p.	3 gm/kilo × 3 days	15	13	87	
"	controls	15	0		0
Tryparsamide					
3000 mg/kilo oral	2 gm/kilo × 3 days	10	8	80	
"	controls	10	3		30
3200 mg/kilo i.p.	1 gm/kilo × 3 days	16	14	87	
"	controls	16	3		18
arsanilic acid					
250 mg/kilo i.p.	2 gm/kilo × 4 days	10	10	100	
"	controls	10	5		50
400 mg/kilo i.p.	2 gm/kilo × 3 days	10	10	100	
"	controls	10	0		0
acetarsone					
4000 mg/kilo oral	2 gm/kilo × 3 days	10	9	90	
"	controls	10	6		60
400 mg/kilo i.p.	2 gm/kilo × 3 days	10	7	70	
"	controls	10	0		0
400 mg/kilo i.m.	2 gm/kilo × 3 days	30	28	93	
"	controls	10	0		0

* Carbarsone was given in the form of the soluble sodium salt. Owing to the low toxicity of this drug (MLD_{50} ca. 15,000 mg/kilo) and the physical difficulties involved in introducing as much as 7.5 cc of a 20 per cent. solution into the stomach of a 100 gm rat, it has not been possible to determine whether *p*-aminobenzoic acid has any protective value when carbarsone is administered orally to this animal.

[1] With acknowledgment to Mr. Charles R. Hamilton for valued technical aid in the conduct of this work.

[2] D. D. Woods, *Brit. Jour. Exp. Path.*, 21: 74, 1940.

[3] F. R. Selbie, *Idem.*, 21: 90, 1940.

[4] J. Maier and E. Riley, *Proc. Soc. Exp. Biol. and Med.*, 50: 152, 1942.

[5] E. K. Marshall, J. T. Litchfield, Jr., and H. J. White, *Jour. Pharm. and Exp. Ther.*, 75: 89, 1942.

that *p*-aminobenzoic acid in some way protects rats against excessive doses of carbarsone. All rats were maintained on the same adequate diet.

To test the validity of these ideas, further experiments were designed with carbarsone and also with such other pentavalent arsenicals as "Tryparsamide" (sodium N. phenylglycinamide-*p*-arsonate), arsanilic acid or atoxyl (*p*-amino phenyl arsenic acid) and acetarsone (*m*-acetylamino *p*-hydroxyphenylarsonic acid). In order to subject our presumptive conclusions to the most rigorous proof, the arsenicals were administered to heterogeneous groups of rats by various routes in dosages that previous experience had shown to be well above their respective minimal lethal ranges. *p*-aminobenzoic acid in the form of its soluble sodium salt was given by various routes in dosages well below the lethal range established by Scott *et al.*[6] All surviving rats were observed for at least ten days before being discarded. Results of a few typical experiments representative of the several drugs used are given in Table 1.

Discussion

Conclusive evidence of the absence of any inhibitory action of *p*-aminobenzoic acid on the trypanocidal potency of the various arsenicals has been obtained. This evidence, together with a discussion of the theoretical implications of the finding, will be presented elsewhere. In the present communication, attention is drawn specifically to the detoxicating action of *p*-aminobenzoic acid against massive doses of the various pentavalent arsenicals used. The protective action is dramatically demonstrated within 24 hours when, as in the case of high intravenous doses of acetarsone, nearly all the control rats are already dead or *in extremis*. On lower but still relatively high doses, particularly when administered by the oral route, some control rats linger on for four or five days, an occasional rat even surviving the experiment. In the earlier stages of the experiment, all the classical signs of pentavalent arsenic poisoning in rats, namely, tremors, gyrations, head tic, incoordination and progressive emaciation, are exhibited by the controls. The number of rats receiving adequate doses of *p*-aminobenzoic acid that show these stigmata is relatively small. Furthermore, some of the treated rats that develop central nervous system disturbances are apparently relieved of their symptoms by the continued administration of *p*-aminobenzoic acid.

In addition to work on this important point, further studies now in progress are designed to determine what pathological lesions due to the arsenical drugs are inhibited by the administration of *p*-aminobenzoic acid. Additional studies of the clinical applications of these findings in man, especially in connection with the arsenical treatment of neurosyphilis, are being undertaken.

[6] C. C. Scott and E. B. Robbins, *Proc. Soc. Exp. Biol. and Med.*, 49: 184, 1942.

Summary

p-aminobenzoic acid has been found highly effective as a detoxicant for high lethal doses of carbarsone and certain other phenyl arsonates in rats.

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ADSORPTIVE FORCES ACTIVE THROUGH GLASS[1]

A major problem in parts of some oil fields is getting the remaining crude petroleum out of sands that have been water flooded. While sand adheres to water in preference to oil and oil may be driven from an oil-saturated sand by water, if considerable water is already present with the oil in the sand, the usual water drive is not effective. The problem of recovering the remaining oil requires a study of the effect of one liquid in causing a solid particle to adhere more firmly to another liquid.

That sand partly wet with water holds crude oil much more firmly than when no water is present with the oil is easily demonstrated in the laboratory with either loose sand or disks of sandstone. The phenomenon is familiar in many aspects; froth flotation, three component emulsions, the flotation of sand grains at the interface between gasoline and water and between water and air and many others. But how can it be measured quantitatively?

A number of methods were tried and discarded in preliminary work. There appears to be no way to get oil and water to lie side by side in alternate strips on the same glass surface. The method finally adopted was to have oil and water on opposite sides of a very thin glass wall. An easily measurable effect of one fluid through the glass on the other fluid was obtained for a few of dozens of fluid combinations tried.

The method used was simply to flow the oil or other fluid through a long, very thin-walled glass capillary, then repeat with water or other fluid in the water jacket outside the capillary at precisely the same temperature. The ratio of times of flow gives the ratio of the fourth powers of the radii of the capillary and hence the thickness of the adsorbed layer. The capillary tube was drawn from ordinary 8 mm tubing (the fusible type of hard glass worked best) and was about 0.8 mm diameter and a meter long with wall thickness about 0.1 mm. It was mounted vertically by means of the undrawn ends, the upper of which was provided with two scratches to define the volume flowed. 100

[1] Published by permission of the Director, Geological Survey, U. S. Department of the Interior.

seconds is a suitable time of flow, but this varied from 50 to over 500. Both inner and outer surfaces of the capillary must be very clean and dry. If a tube was to be used a second time it was cleaned with strong chromic acid solution. Fluids to be used were left over night close to the apparatus in a room where the temperature seldom varied more than one degree.

Several runs with a sulfur-free crude oil gave a time of flow of 110 seconds with and 103 seconds without water jacket, the ratio 110 : 103 = 1.068, of which the fourth root is 1.0166. The tube radius 0.4 mm divided by 1.0166 is .3935; or the radius is decreased by .0065 mm = 6.5 microns or 6.5×10^{-4} cm. If the adsorbed portion of the oil consists of the larger polar molecules, 6×10^{-6} cm is a reasonable estimate of their length. A layer of these 6.5×10^{-4} cm thick would therefore be about 100 molecules deep. The adsorptive force of silica for water is known to die out after the adsorbed layer becomes about 100 molecules deep (4×10^{-6} cm). This is of course far too small to be observed by flow methods.

Of over thirty combinations tested, about half showed no observable increase in time of flow due to an exterior liquid and none showed an effect exceeding that of the crude oil-water pair. Fresh soap solution gives an effect nearly as large, but sineresis (and aging) soon bring it below an observable limit. Apparently the long molecules lie parallel to the glass surface. Stearic acid dissolved in chlorex gave 5.8 microns, myristic acid 4.0. With sodium carbonate solution outside, the latter showed the same adsorption (4.0) as with pure water in the water jacket. Apparently the strongly basic sodium ions did not add to the effect of the water. A benzene extract of used fuller's earth showed no observable effect of a water envelope, but an ethylene glycol extract did, 2.1 microns decrease. Triethanolamine and 1 per cent. gelatine solution gave no effect, but crepe rubber in benzene gave 2.8 microns decrease.

In flowing crude oil through a fresh tube, the time of flow became constant only after about five minutes, the first run being about 3 per cent. faster than in the steady state as though several minutes were required to complete the adsorbed film. After application of the water outside, there was a similar delay in coming to an equilibrium. The observed effect is not due to compression for many liquids failed to show it.

There seems to be no question that the adsorption of hydroxyl or other anions on one side of a thin glass wall can enhance the adsorption of electropositive material on the opposite side by a measurable amount through at least 0.1 mm of glass. The action of the glass electrode in measuring pH appears to be of a similar nature. Although cell walls are not impermeable, attractive effects through them may well alter the Donnan equilibrium.

P. G. NUTTING

U. S. GEOLOGICAL SURVEY

SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE SEPARATION AND CONCENTRATION OF THE ISOHEMAGGLUTININS FROM HUMAN SERUMS[1]

THE difficulty of obtaining donors who possess high-titred isoagglutinins in their serums made it desirable at the Army Medical School to prepare from random A and B donors human isohemagglutinating serums of uniformly high titer and constant potency. During the course of this study, it was discovered that proteins containing isoagglutinins can be separated from both Group A and B serums with little or no loss of hemagglutinin activity by precipitation with methanol and that after this separation, they can be concentrated to the desired isoagglutinin titer.

The method is simple enough for general use and may be easily applied to large-scale production. The conditions under which separation and concentration is obtained follow.

Ten volumes of pooled group specific human serum obtained from fasting donors are added to 5 volumes of an acetate buffer of ionic strength 0.4[2] and pH 5.4 and to 7.5 volumes of distilled water. The solution is mixed and chilled to 1° C., and this temperature is maintained during the preparation of the concentrated isoagglutinins. Seven and five tenths (7.5) volumes of C.P. methanol (previously chilled to 1° C.) is slowly added with gentle stirring through a capillary tube at the rate of 0.25 volumes per minute to the protein buffer mixture. The final concentration of methanol is 25 per cent., the pH near 6.5 and the final ionic strength about 0.13. The mixture is allowed to stand at 1° C. for one hour. The proteins separating under these conditions are removed by centrifugation in the cold room or in a refrigerated centrifuge at 2,500 r.p.m. for 30 minutes. The precipitated proteins are washed once with 25 per cent. methanol (optional) and as much as possible of the excess methanol solution allowed to drain off by inverting the centrifuge tubes on filter paper.[3]

The separated material is then dissolved in the desired amount of M/15 phosphate buffer of pH 7.8[4]

[1] From the Blood Research Division, Army Medical School, Washington, D. C.

[2] A. A. Green, *Jour. Am. Chem. Soc.*, 55: 2331, 1933.

[3] The precipitate can also be freed of methanol by the application of vacuum.

[4] W. M. Clark, "Determination of Hydrogen Ions," Williams and Wilkins, Baltimore, 1928.

containing 1 mg of merthiolate per ml, the final pH being about 7.2. The proteins dissolve readily in the buffer solution, yielding clear solutions at protein concentrations greater than 10 per cent. It is the practice here to dissolve the precipitated proteins in a volume of buffer equal to one quarter of the original serum volume. By this means, sufficiently high concentrations have always been obtained. The solution may be further clarified by recentrifugation at high speed or by filtration through a fine sinter-glass filter. The proteins precipitated under the above conditions comprise about 10 to 15 per cent. of the total serum proteins and contains from 90 to 100 per cent. of the isoagglutinating activity originally present in the pooled serums.

The separated and concentrated material lends itself well for blood-grouping purposes. It is not as viscous as whole serum, but possesses sufficient surface tension to form well-rounded droplets on a glass slide. The addition of merthiolate to a final concentration of 1:1000 does not appear to interfere with the interactions of the isoagglutinins with the red cells and further eliminates the necessity for filtering out bacteria. The isoagglutinating activity of the separated globulines stored at room temperature (25° C) remained unimpaired for four weeks.

Employing the macroscopic slide technique, the concentration of this material can be adjusted so that agglutination with incompatible erythrocytes occurs visibly in 5 seconds time, with complete agglutination occurring in 60 seconds.

Studies are now in progress on the physico-chemical and immunological properties of the separated and concentrated proteins, and attempts are being made to further purify the isoagglutinins from this material. The details of this study will be reported later.

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A SIMPLE PROCEDURE FOR THE RECOVERY OF AGAR

RECENTLY, there was published a notice[1] of the War Production Board's request that agar be conserved. It was suggested that work be done on developing methods whereby agar may be recovered from culture media and re-used.

In this connection, therefore, attention is called to the common practice in the manufacture of agar of dissolving it in hot water and then removing the water by freezing.

A satisfactory procedure for the recovery of agar, based on the freezing method, has been employed in this laboratory. Discarded culture media containing agar is kept in separate waste pans from liquid media. This used media is autoclaved as usual for the purpose of sterilizing, and while still in the fluid state is filtered through cheese-cloth to remove coagulated proteins, *i.e.*, blood and serum. It is then poured into trays from the freezing compartment of a refrigerator and allowed to cool. The trays are returned to the freezing compartment and left overnight.

The following morning the frozen material is rapidly melted in warm alcohol. The aqueous alcohol, containing the particles of agar, is filtered, with cheese-cloth again being used instead of paper in order to speed the filtration. The agar thus collected is washed repeatedly with distilled water.

Dehydration of the agar is secured by washing with alcohol. We have found it convenient, following the washing with water, to gather the corners of the cheese-cloth together to form a sack. This sack is immersed in 95 per cent. alcohol and compressed to remove the water. The shreds of agar thus obtained are spread out in a porcelain evaporating dish and dried by placing in a 37° C. incubator or in a desiccator.

Agar recovered in this manner is as satisfactory as the fresh commercial product. The quantity recovered depends largely on the care taken in handling the material throughout the above procedure.

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[1] *News Letter of the Society of American Bacteriologists*, Vol. 8: No. 2, p. 3, Office of the Secretary-Treasurer, April, 1942.

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